Kelly Fine – April 26, 2011
Texas Aerospace Scholars (TAS) Intern
Internship mentor: Dr. Richard Danielson
Audiology and Hearing Conservation, JSC/SD38

FORMATTING OF ON-ORBIT HEARING ASSESSMENTS (OOHA'S) ON ISS

http://sd.jsc.nasa.gov/sd13/auhcon/default.aspx

- Superior, Wisconsin
- B.S. Biology / Chemistry minor

Texas Aerospace Scholars (TAS)

- Texas Aerospace Scholars
- NASA Space Research Grant
  - Southwestern Oklahoma State University – Research Assistant
- Texas High School Aerospace Scholars program

Presentation Outline

- Hearing & Hearing Loss Prevention among crewmembers
- Roles and tasks during internship in Audiology Clinic
- PROJECT: **Formatting of OOHA data**
  - BARRIOS templates
- Results / Conclusions

Importance of Good Hearing and Hearing Loss Prevention

Expedition 26 crew

- Improve mission success
  - Understanding signals, alarms, and instructions
- Important for communication
  - Be able to hear and be heard
  - International Space Station conditions
- Enhance quality of life *(life-long)*

http://www.nasa.gov/images/content/506550main_exp26_greeting_med_thum.jpg

How can NOISE impact on Crew Health and Mission Safety?

Consider effects of spaceflight sound levels on:
Risks for developing hearing loss *(permanent, temporary)*
*Possible disruptions of crew sleep due to noise
*Interference with speech intelligibility and communications due to noise
*Possible interference with crew task performance due to noise
*Possible reduction in Alarm Audibility due to noise

Noise countermeasures

- **Engineering controls, flight rules**
- **Hearing Loss Prevention (HLP) program**
  - Hearing Protection
  - Periodic monitoring of hearing

- ***What's needed of an intern?***
  - Comprehensive review and audit of hearing data from Increments 1-current
    - Update data in EMR as necessary
    - Develop a protocol for displaying data in reports

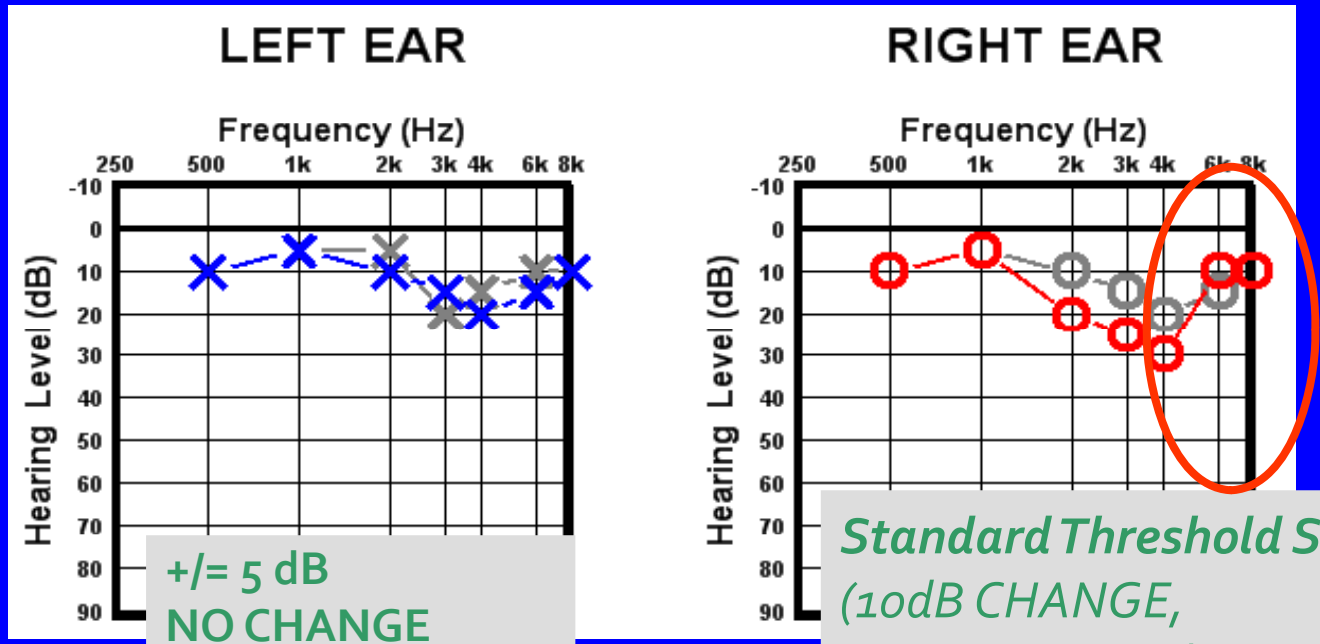
Prophonics picture:
http://www.sensaphonics.com/wp-content/uploads/er_series_main.jpg

My role at JSC

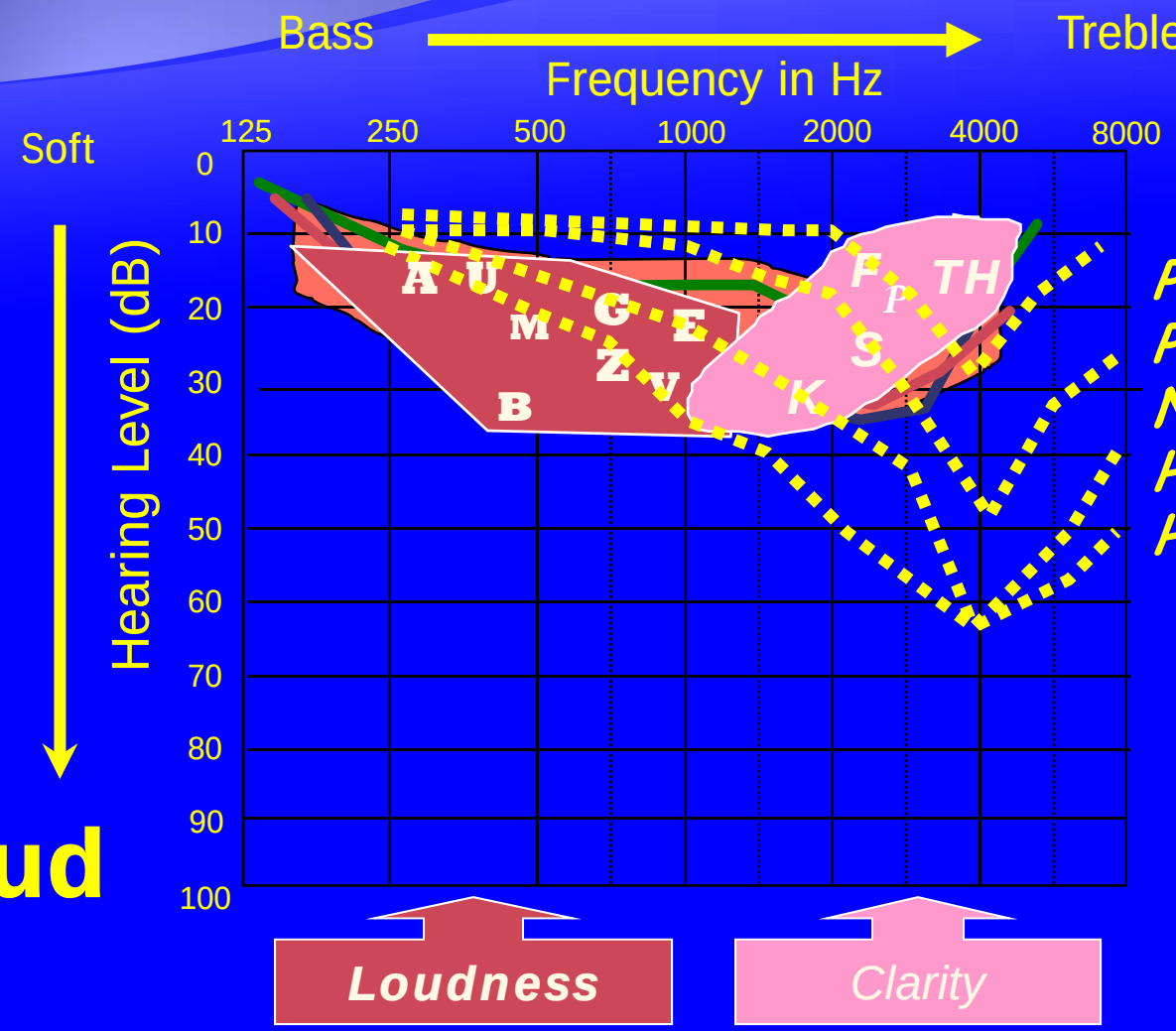
- *Gain knowledge regarding:*
  - *Hearing function*
  - *Risks of excessive noise exposure*
  - *Strategies for hearing loss prevention*
  - *Education in hearing conservation, custom ear-ware, fit-checks*
- *Audit all Electronic Medical Record (EMR) for completeness of On-orbit hearing assessment (OOHA) data and Pre/Post-flight audiometry entries*
- *Integrate all OOHA data found in **Sharepoint** into EMR records and plots*
- *Update Audiology Procedures and Policies*

Audiogram/ Pure tone Audiometry

- Hearing Threshold – the softest tone that a person can detect at least 50% of the time
- Audiogram- reports hearing sensitivity in terms of loudness (hearing level) and pitch (frequency)
- Standard Threshold Shift- Permanent Threshold Shift (PTS) or Temporary Threshold Shift (TTS).



Typical Long-term Effects of Noise on Human Hearing Thresholds



Patterns of Progressive Noise-related High Frequency Hearing Loss

Identification of "Hearing Loss"
with auditory monitoring (conventional and on-orbit)

Audiometry can reveal Permanent Threshold Shift

On-Orbit Hearing Assessment (OOHA) can reveal Temporary Threshold Shift on ISS

OOHA Training

Baseline audiometry, Baseline OOHA

OOHA

L+14, once/month thereafter

OOHA

once/45 days thereafter

Post-flight audiometry

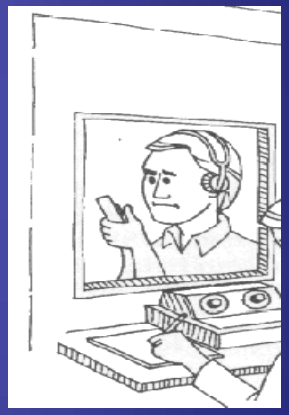
R+1 to R+3

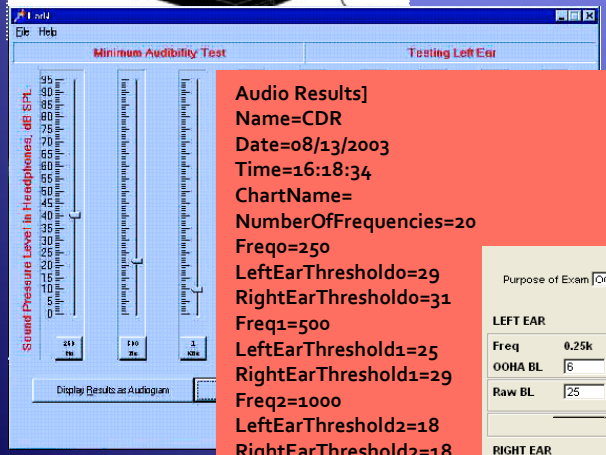
Annual Audio-metry

R+30

On –Orbit Hearing Assessment

OOHA data can be formatted into a conventional audiogram and detect temporary threshold shifts (TTS) while on the ISS.





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LeftEarThreshold0=29
RightEarThreshold0=31
Freq1=500
LeftEarThreshold1=25
RightEarThreshold1=29
Freq2=1000
LeftEarThreshold2=18
RightEarThreshold2=18
Freq3=2000
LeftEarThreshold3=18
RightEarThreshold3=18
Freq4=3000

Purpose of Exam: OOHA Baseline Audiogr | Mission: SAMPLE | Exam

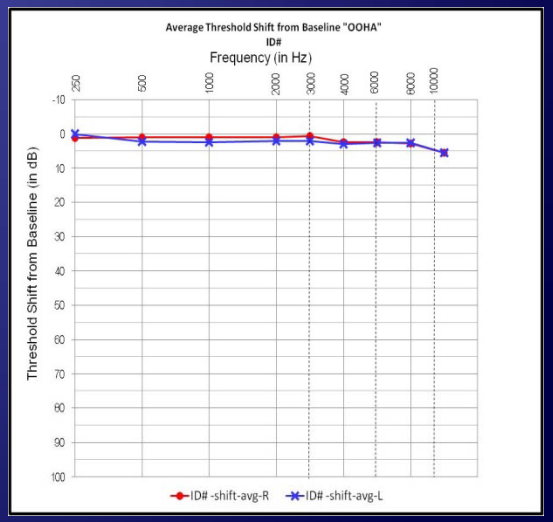
LEFT EAR

Freq	0.25k	0.5k	1k	2k	3k	4k	6k	8k	10k
OOHA BL	6	5	5	5	3	12	12	14	11
Raw BL	25	24	21	21	15	22	26	29	20

RIGHT EAR

Freq	0.25k	0.5k	1k	2k	3k	4k	6k	8k	10k
OOHA BL	0	11	12	10	10	15	13	13	11
Raw BL	19	30	28	26	22	25	27	28	20

Comments: (SAMPLE DISPLAY of how OOHA data can be converted to



Description of BARRIOS Data Display

- *Why was BARRIOS program designed?*

  A: Excel charts were disproportional; needed to be displayed and plotted correctly to ANSI (American National Standards Institute) standards

  - BARRIOS program was implemented by previous intern Amy Oliver

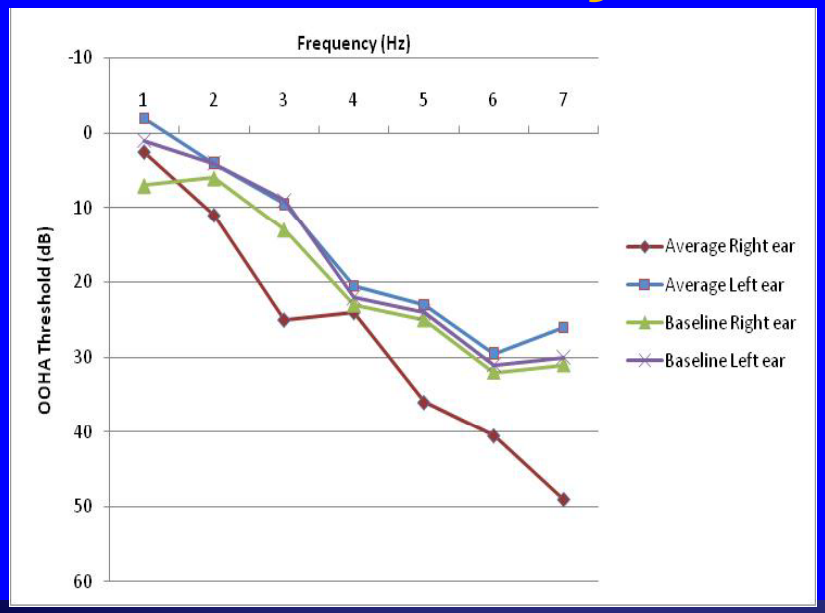
- *What types of comparisons can we see within the BARRIOS program?*

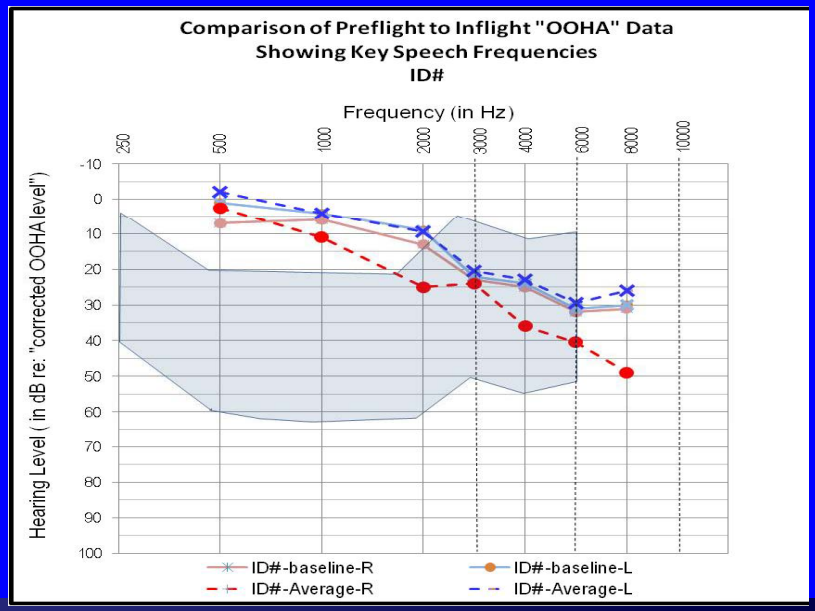
  A: Baseline / Annual Audiograms

  Pre / Post-flight data

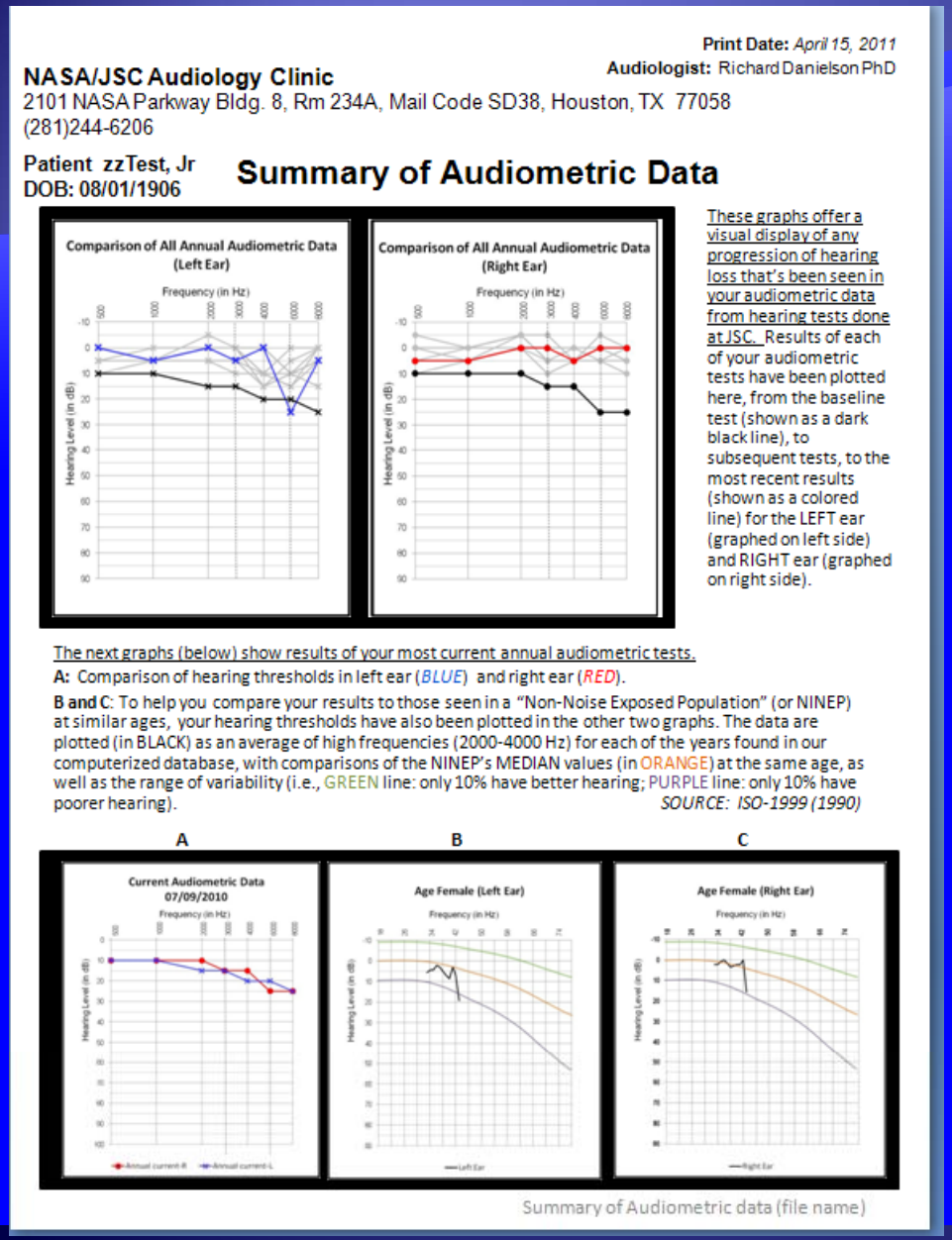
  Baseline OOHA / 4-5 OOHA's

Why show comparisons?





My roles re:



Print Date: *April 15, 2011*
Audiologist: Richard Danielson PhD

NASA/JSC Audiology Clinic
2101 NASA Parkway Bldg. 8, Rm 234A, Mail Code SD38, Houston, TX 77058
(281)244-6206

Patient zzTest, Jr
DOB: 08/01/1906

Summary of Audiometric Data

Comparison of All Annual Audiometric Data (Left Ear)

Comparison of All Annual Audiometric Data (Right Ear)

Frequency (in Hz)

Hearing Level (in dB)

These graphs offer a visual display of any progression of hearing loss that's been seen in your audiometric data from hearing tests done at JSC. Results of each of your audiometric tests have been plotted here, from the baseline test (shown as a dark black line), to subsequent tests, to the most recent results (shown as a colored line) for the LEFT ear (graphed on left side) and RIGHT ear (graphed on right side).

The next graphs (below) show results of your most current annual audiometric tests.

A: Comparison of hearing thresholds in left ear (*BLUE*) and right ear (*RED*).

B and C: To help you compare your results to those seen in a "Non-Noise Exposed Population" (or NINEP) at similar ages, your hearing thresholds have also been plotted in the other two graphs. The data are plotted (in BLACK) as an average of high frequencies (2000-4000 Hz) for each of the years found in our computerized database, with comparisons of the NINEP's MEDIAN values (in ORANGE) at the same age, as well as the range of variability (i.e., GREEN line: only 10% have better hearing; PURPLE line: only 10% have poorer hearing).

SOURCE: ISO-1999 (1990)

A B C

Current Audiometric Data 07/09/2010

Age Female (Left Ear)

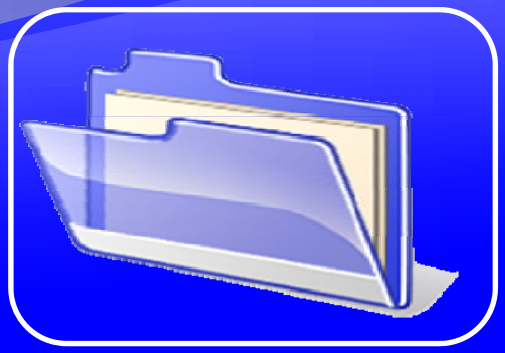
Age Female (Right Ear)

Summary of Audiometric data (file name)

- Updating templates for displaying data in functional plots for data review and patient education
- Posting audiologist's signed OOHA reports on Audiology ***Sharepoint*** site as Lab Reports for audiologist's approval and release to flight surgeons

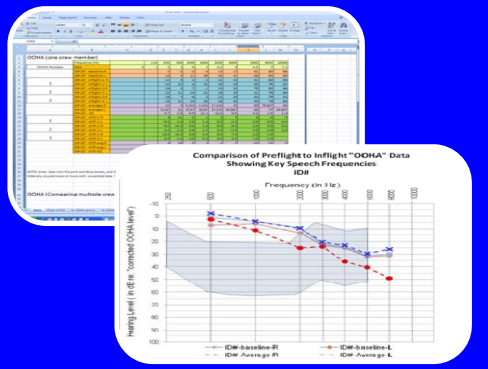
OOHA – ISS to users

ISS OOHA



Sharepoint

EMR

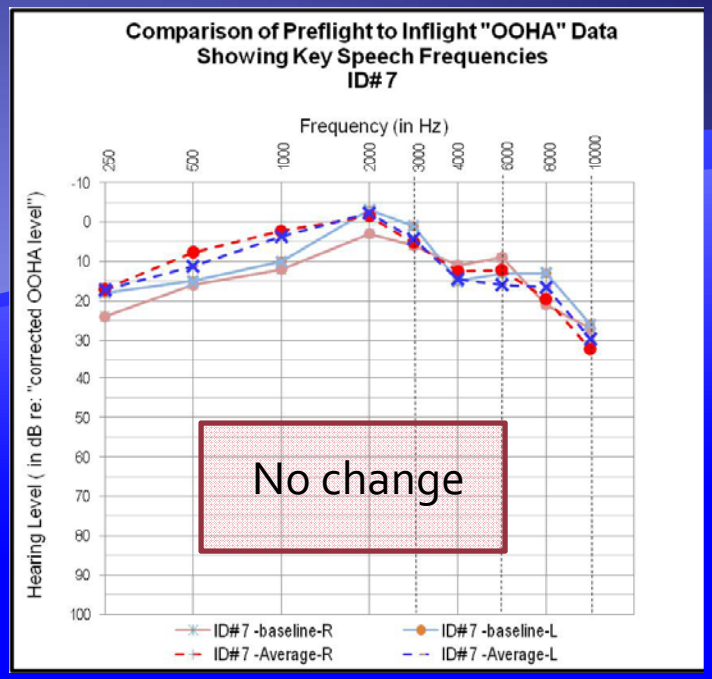


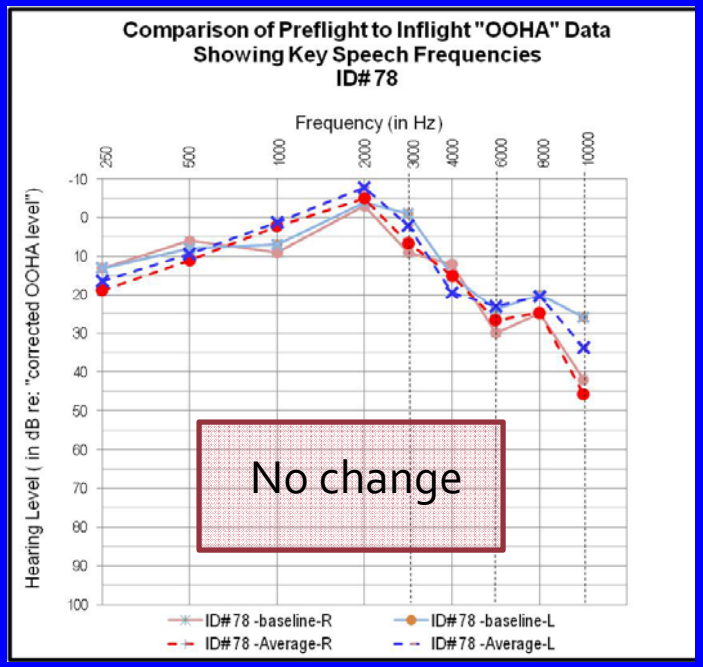
Audiology Templates

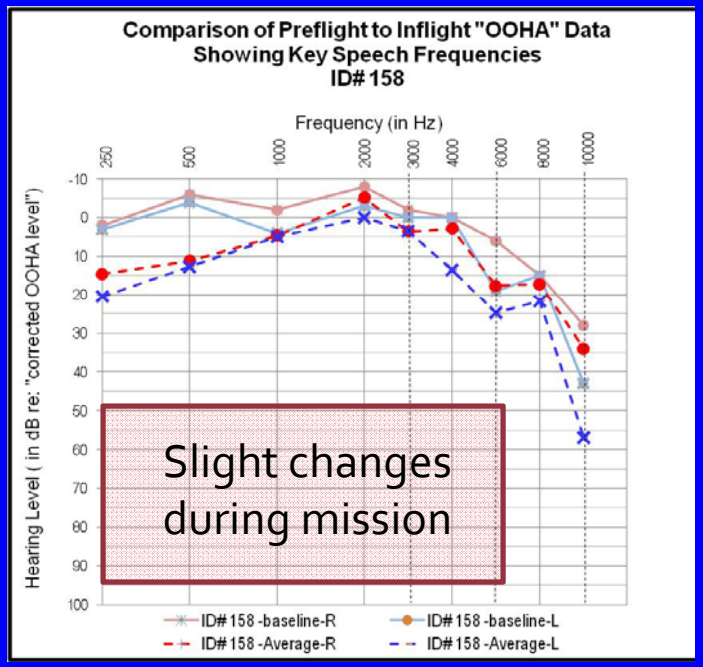
Audiologist

Flight Surgeon/Crewmembers

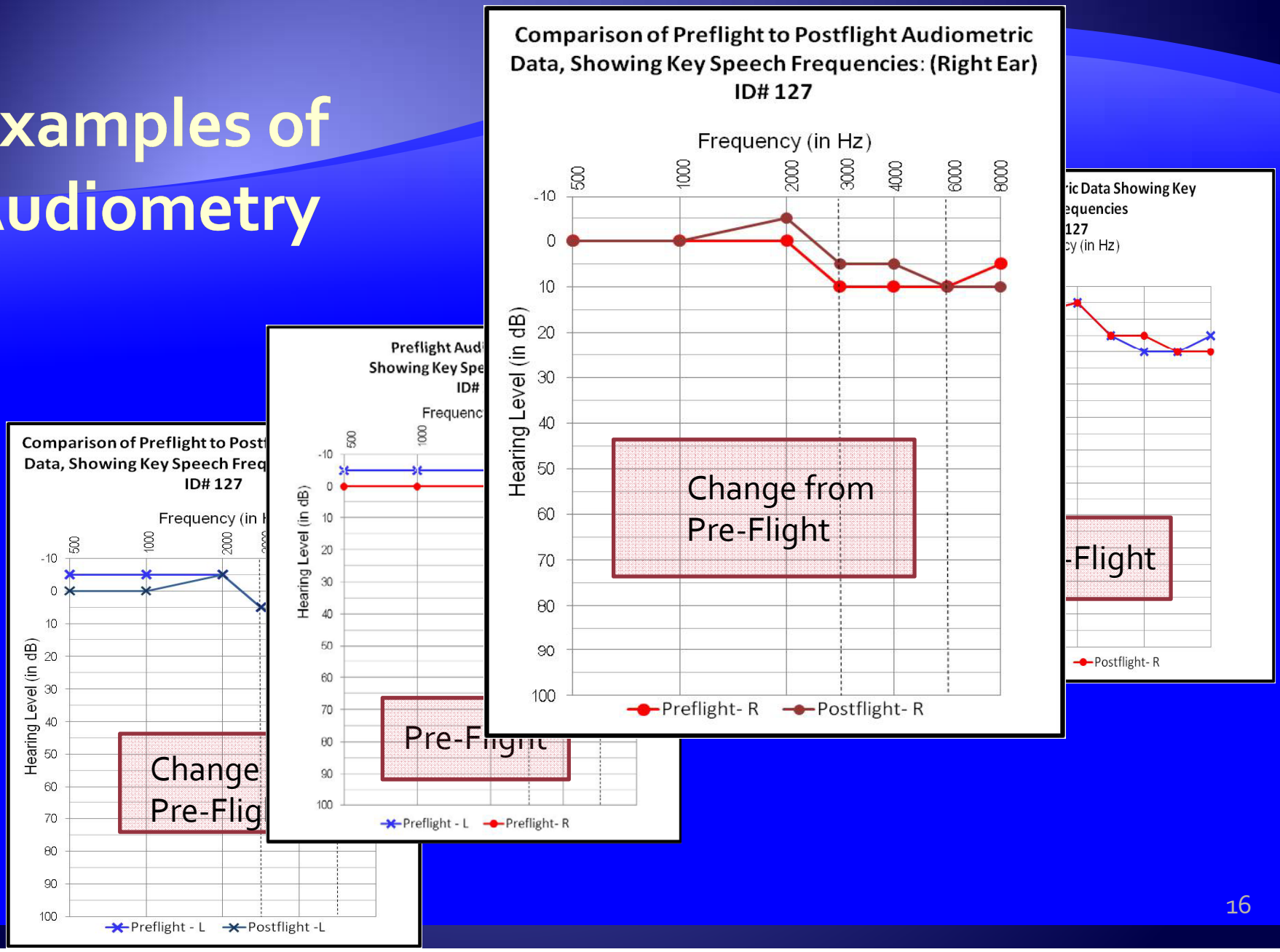
Examples of OOHA's







Examples of Audiometry



Summary of Internship Experience

- ✓ Became educated about Audiology and Hearing Loss Prevention
- ✓ Created custom templates for reports to patients and health care providers
- ✓ Created procedure for generating expedited displays of OOHA and audiometric data
- ✓ Updated other Audiology procedures and policies for Clinical Services Branch

JSC Building 8 Clinic

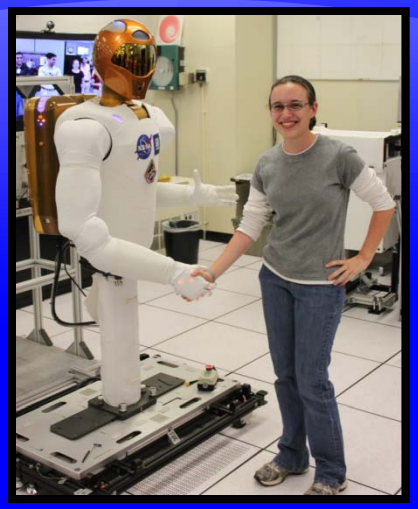
Future Plans

- Shovel snow!
- Graduate with B.S. Biology
- Continue to work in clinical health sciences
- Advocate Hearing Loss Prevention!

Lake Superior College

Activities / Experiences

- **Professional growth and accomplishments**
  - *Experience with documenting Procedure and Policies*
    - *Professional formats, citing sources correctly*
  - *Becoming familiar with Microsoft: Excel, PowerPoint, and Word*
  - *Improving public speaking*
  - *Exposure to real work experience*
- **Multiple Tours**
  - *JSC, Houston*
- **Activities**
  - *Challenger Center "Family Space Night" Brazos Bend State Park*
  - *League City Animal Shelter*
  - *College Aerospace Scholars (CAS) mentor*
  - *Ballroom Dancing*
  - *Referee at First Tech Challenge – High school Regional competition at San Jacinto College*



Acknowledgements

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- Tracie Conn
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Thank you!